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Nearly 40 scientists from 9 countries outside Russia attended the conference. The countries supplying the most participants were France, Britain, and the United States. They were joined by a rotating collection of about 80 Russian scientists affiliated with the ten institutes of the Russian Academy of Science (RAS) which provided speakers for the conference. Russian speakers came from institutes of RAS in Moscow, Novosibirsk, St. Petersburg, and the Ukraine.

The conference was beneficial for all. The visiting western scientists were given access to some of the latest Russian developments in the technologies for parallel computer programming, met Russian scientists that had participated in legendary projects such as BESM and MARS, and could make or renew acquaintances with leaders of the Russian research institutes that are just coming into the world market as reliable providers of inexpensively priced, high quality computer systems software. They also had free access to the many cultural treasures of Moscow and could see Russian society firsthand in the transition between centrally controlled and individually directed economies.

The Russians were given badly needed opportunities to meet western corporate and academic computer scientists with which they must soon form economic and scientific alliances if they are to survive personally and professionally.

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Conference on Software for Multiprocessors and Supercomputers

The Principal Investigator made two trips to Moscow Russia in connection with this grant. They were his third and fourth trips to Moscow in 1994 in support of joint Russian American research in computer science, especially high performance computing software and hardware. This grant specifically contained funds to help support the Second International Conference on Software for Multiprocessors and Supercomputers: Theory, Practice, Experience (SMS TPE 94) held in Moscow on 19-23 September 1994. It was co-sponsored by the Office of Naval Research and the Russian Basic Research Foundation.

AUGUST PLANNING SESSIONS FOR THE CONFERENCE - TRIP 3

There were planning sessions for the upcoming conference during the week of 15-19 August 1994. All were held in the Institute for Systems Programming at 25 Bolshaya Kommunisticheskaya Street near the Taganskaya metro. Most but not all of the foreign attendees had already given their arrival times. Busses and vans were contracted to carry them from the Moscow Sheremetyevo Airport to the conference site, a well-guarded conference center and hotel complex run by the Academy of Management. This fenced hi-rise complex is at 84 Vernadsky Prospect, near the Yugo-Zapadnaya metro and market, just south of Moscow State University. Email was used to confirm the schedules of the remaining visitors.

It was planned to gather registration fees and to distribute foreign visitor support funds to invited speakers and tutorial givers during the registration period of the first morning of the conference. Plans were made for visitor cultural events, including a mid-week tour of Red Square and the Kremlin, plus weekend trips to the Izmaillovskii Park tourist market in Moscow, the historic walled religious center at Zgorsk near Moscow, and the ancient Russian town of Suzdal near industrial Vladimir four hours by bus from Moscow. During the conference itself, the bus trip to Suzdal and Vladimir was dropped as too arduous to occur reliably during a single day over existing roads.

SOFTWARE FOR MULTIPROCESSORS & SUPERCOMPUTERS - SEPTEMBER 1994

The Second International Conference on Software for Multiprocessors and Supercomputers: Theory, Practice, Experience (SMS TPE 94) was held in Moscow on 19 through 23 September 1994. The first two days were filled with three tutorials, given in lecture rooms of the Faculty of Computing, Mathematics and Cybernetics (College of Computer Science and Applied Mathematics) at Moscow State University to enable large numbers of students to attend. Moscow State has roughly seventy thousand (70,000) students and is the largest educational institution in Russia.

The first full day tutorial (**Parallel Computer Systems: Past, Present, and Future**) was presented on Monday 19 September by Prof. Tom Casavant of the Electrical and Computer Engineering Department of the University of Iowa (USA). The next day featured two simultaneous full day tutorials: **Parallel Processing for Computer Graphics** by Prof. Alan G. Chalmers of the University of Bristol (UK); and **Programming Transputers Using C** by Profs. Rodney S. Tosten of Gettysburg College and Paul T. Tymann of SUNY Oswego (USA).

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The last three days were held in the palatial marble conference center within the hotel complex on Vernadsky Prospect. The 52 talks were organized into seven sections totaling 20 sessions:

    I.   Languages, Compilers and Programming Systems with 12 papers given in 4 sessions;
    II.   Neural Networks with 3 papers given in one session;
    III.   Applications with 6 papers given in 2 sessions;
    IV.   Architectures with 7 papers given in 3 sessions;
    V.   Environments, Debugging & Monitoring with 14 papers given in 6 sessions;
    VI.   Parallelization Techniques, Scheduling & Load Balancing with 5 papers given in 2 sessions;
    VII. Numerical Algorithms with 5 papers in 2 sessions;

After a starting delay of more than one hour because of an unexpectedly slow registration process, conference presentations began on Wednesday 21 September with a lively keynote talk by Peter Welch of the United Kingdom about **The Importance of Thinking Parallel.** He was preaching to the choir but did so with an enthusiasm that sparked the rest of the conference. The second keynote presentation began the talks on Thursday 22 September: Dyke Stiles of the United States speaking on **Parallel Simulated Annealing on Distributed Memory Systems.** The last day Friday 23 September began with a tour of the Kremlin and Red Square in the center of Moscow.

The technical highlight of the conference was Vladimir V. Voevodin's presentation entitled **Use of the V-Ray System for Optimisation of Serial Programs for Cray Supercomputers.** His session was moved to the great hall of the conference to accommodate the number of interested attendees. The paper briefly describes his V-RAY algorithm graph compiler technology for transforming serial programs with optimal parallelization, for finding data locations (local vs. remote memories, register vs. memory) that best speedup code overall, and for extracting all possible execution parallelism from a transformed program. The V-Ray technique is said to characterize a program by an algorithm graph that shows all possible dependencies between statement instances and all data references, so both parallel execution and data location can be analyzed and optimized relative to the target computer configuration and architecture. Applying the V-Ray software to the TRFD code in the Perfect Club benchmarks for Cray Y-MP systems produced speedups of 20 to 30 over the original sequential code when run in parallel on 8 processors and speedups of 2 to 3 over the best known hand optimization of TRFD available from Cray Research itself. The speedups of 2 to 3 over hand optimized code were true for 1, 4, and 8 processor Y-MP M90 and C90 systems. Hand and V-Ray parallel implementations were compared on exactly the same machine configurations.

The two sections with 10 sessions on programming languages or environments for parallel computers together had 26 papers, half of all in the conference. The topics of efficient techniques and tools for programming parallel computers are very important to Russian computer scientists. Some of the Russian projects are innovative and unlike prior work in the West; many others are openly acknowledged to be local implementations of new technologies already introduced in the West. This we-can-do-it-here-too attitude toward technology was especially important within an older Soviet system that was isolated from Western developments by the past constraints of Cold War enmities. Much of the most important new work is based firmly upon mathematical foundations that have not yet been exploited outside Russia. Well educated mathematicians within Russia are producing world-class computing algorithms.

Other interesting parallel language systems papers in the conference proceedings include:

1. Guido Wirtz, Univ.-GHS-Siegen, Germany, **The MEANDER Language and Programming Environment** which describes a prototype system combining textual and graphical programming languages to simplify the creation of efficient parallel programs (session A2);

2. S. Katserov, S. Gaissaryan, *et al*, Moscow State U and Institute for System Programming, Russia, **Retargetable Compiler of ANSI C Superset for Vector and Superscalar Computers** which introduces the constructs of **C[]** (C-brackets) added to ANSI C to allow portable compilers to produce simple efficient code for all vector and superscalar computers, such as vector values (e.g., for expressions or array elements), storage location L-vectors, vector operators, reduction operators (e.g., sum all elements of a vector) and parallel control structures *par* and *pipe* (session A5);

3. Valery Torgashev and Igor Tsaryov, St. Petersberg Institute for Computer Science and Automation, Russia, **Object-Oriented Language for Distributed Computations** which describes a recent revision of an ambitious but still overly complex language for defining both highly parallel data flow graph reduction programs and their imbeddings into large multiprocessor and multicomputer systems using either a graphical programming editor or a text-oriented compiler(session A5);

4. Olivier Michel, *et al*, Universite Paris Sud, France, **A Data-Parallel Declarative Language for the Simulation of Large Dynamical Systems and its Compilation** which uses operations of the language **8 1/2** on synchronous clock-discretized streams of the changing values of variables and on collections of streams distributed over parallel processing elements to provide a terse but expressive and mathematically sound high-level formulation for rapid parallel simulation of the mathematical behavior of dynamic systems expressed in terms of continuous variables, discrete events or both (session A6); and

5. N.A. Konovalov, V.A. Krukov, *et al*, Keldysh Institute of Applied Mathematics, Russia, **Fortran DVM - Language for Portable Parallel Program Development** which is a Fortran extension based on abstract and virtual parallel machines designed to allow efficient running portable compiled code for either message passing parallel computers, shared memory multiprocessors, or distributed virtual memory (DVM) computers (session A6).

An interesting parallel programming environment paper in the conference proceedings is:
V.F. Alexakhin, *et al*, Keldysh Institute of Applied Mathematics, Russia, **Monitoring and Debugging in *RAMPA*** which supports post-mortem debugging of parallel programs written in several different languages, displays behavior traces in synchrony with source code, provides both forward and reverse replay, allows formal classification and analysis of equivalent parallel program sequentializations, and monitors for complex multiprocessor events described using standard database query languages (session A8).

SUMMARY FOR SOFTWARE CONFERENCE SMS TPE 94

Nearly 40 scientists from 9 countries outside Russia attended the conference. The countries supplying the most participants were France, Britain, and the United States. They were joined by a rotating collection of about 80 Russian scientists affiliated with the ten institutes of the Russian Academy of Science (RAS) which provided speakers for the conference. Russian speakers came from institutes of RAS in Moscow, Novosibirsk, St. Petersburg, and the Ukraine. Conference organizers were assisted by a few student volunteers, mainly their own twenty-year-old children.

The conference was beneficial for all. The visiting western scientists were given access to some of the latest Russian developments in the technologies for parallel computer programming, met Russian scientists that had participated in legendary projects such as BESM and MARS, and could make or renew acquaintances with leaders of the Russian research institutes that are just coming into the world market as reliable providers of inexpensively priced, high quality computer systems software. They also had free access to the many cultural treasures of Moscow and could see Russian society firsthand in the transition between centrally controlled and individually directed economies.

The Russians were given badly needed opportunities to meet western corporate and academic computer scientists with which they must soon form economic and scientific alliances if they are to survive personally and professionally. This exposure to western professionals was one reason for the volunteer help by the grown children of the conference organizers. These students also were the most reliable assistants that their parents had available for a few days of free help. The persons organizing SMS TPE 94 also gained much needed experience in running a scientific conference in which participants have free run of the environs and make requests that have not been anticipated.

The previous SMS Conference was held in Saint Petersburg in 1993. Some 1993 papers have been published as an appendix to the 1994 SMS TPE Conference proceedings, all available for roughly (USA) $50 from:

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